

★MATW

V07

98-226013/20

★JP 10068904-A

Solar energy condensing unit for illuminating interior of building, tunnel, subterranean passage - includes collector with several condenser lenses which are arranged corresponding to different focus points of solar light beam which differs according to rotation of earth

MA'TSUSHITA ELECTRIC WORKS LTD 96.08.28 96JP-226200

P81 Q71 (98.03.10) G02B 27/00, F21S 11/00 ,

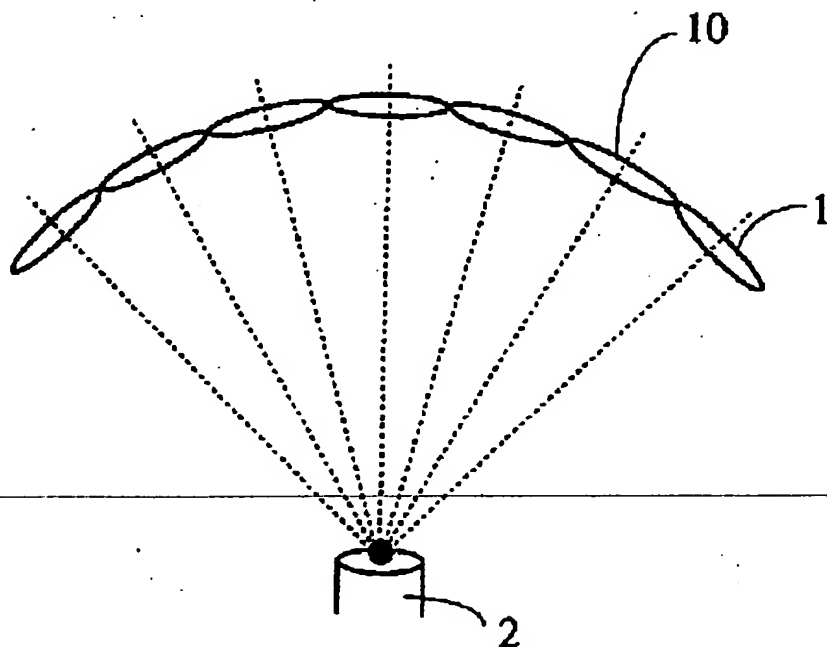
The condensing unit includes an optical fibre (2) which has a core surrounded by a clad layer. A gap is formed between the core and clad layer. The core includes an independent phase or compound phase of silica aerogel which consists of porous structured silica. One end of the optical fibre is installed in the centre part of a light receiving surface.

A collector (10) is installed in front of the optical fibre, in the light receiving surface. The collector includes several condenser lenses (1) which are sequentially arranged in inclined manner to form a semicircular shape. Each condenser lens is arranged corresponding to different focus points of the solar light beam which varies according to the rotation of earth.

ADVANTAGE - Prevents transmission loss of solar light beam. Increases light receiving angle of optical fibre. Eliminates need for tracking sun's position with respect to earth. (8pp Dwg.No.1/8)

N98-179497

V07-N03



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# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 10-068904

(43)Date of publication of application : 10.03.1998

(51)Int.Cl.

G02B 27/00

F21S 11/00

(21)Application number : 08-226200

(71)Applicant : MATSUSHITA ELECTRIC WORKS LTD

(22)Date of filing : 28.08.1996

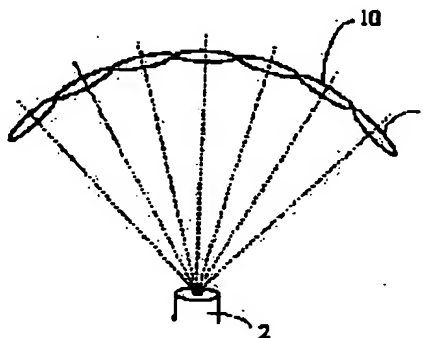
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## (54) SUNLIGHT CONDENSING DEVICE

### (57)Abstract:

**PROBLEM TO BE SOLVED:** To make it possible to condense the sunlight without tracing the sun by using optical fibers having clad layers formed of the independent phase of silica aerogels or the composite phase thereof and installing a condenser arranged with plural condenser lenses inclined successively to an approximately dome shape on the top of the photodetecting surfaces of these fibers.

**SOLUTION:** The optical fibers 2 constituted by integrally providing the outer peripheral surfaces of cores with the clad layers formed of the independent phase of the silica aerogels consisting of the porous skeleton of silica or the composite phase composed of the silica aerogels and gaps are used and are installed in a central part by forming the one-side ends of the optical fibers 2 as photodetecting surfaces. The condenser 10 arranged with the plural convex lenses 1 inclined successively as the condenser lenses is installed on the top of the photodetecting surfaces of the optical fibers 2. The plural convex lenses 1 are respectively arranged in the east and west direction and the north and south direction to form an approximately dome-like curved surface. The convex lenses 1 are so arranged that their focuses are formed on the photodetecting surfaces of the optical fibers 2 when the central axes thereof are paralleled or approximately paralleled with the sunlight.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

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**DETAILED DESCRIPTION**


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**[Detailed Description of the Invention]**
**[0001]**

[The technical field to which invention belongs] this invention relates to the sunlight beam condensing unit which can introduce sunlight into dark places, such as indoor [ of a building ], and a tunnel, an underground passage, in detail about the sunlight beam condensing unit which condenses sunlight and conveys the light in an optical fiber.

**[0002]**

[Description of the Prior Art] Conventionally, sunlight is condensed, as a method of transmitting the light to a dark place using an optical fiber, sunlight is completed with the combination of the condensing means of optical system, such as a convex lens and a full flannel lens, and the method of introducing in an optical fiber is mentioned as indicated by the official report of JP,55-53310,A.

[0003] By the way, the optical fiber consists of wrap clad layers in the superficies of the core which generally serves as a conveyance way of light, and this core, and material with a refractive index smaller than core material is used for the clad plate which forms the clad layer. In an optical fiber, the light-receiving angle of an optical fiber and the total reflection angle of the light in the interface of core material and a clad plate become large, so that the difference of the refractive index of a clad plate and core material is large. Conventionally, as core material of an optical fiber, transparent liquids, such as plastics of acrylic, such as glass, such as quartz system glass and multicomponent system glass, and methyl methacrylate, or a styrol system or tetrachlorethylene, are used. Moreover, the acrylic plastics in which the glass, such as a low soda lime system and a borosilicate glass system, the vinyl chloride, allyl-compound diethylene glycol carbonate, and the fluorine of a refractive index were added, and the refractive index was reduced rather than core material as a clad plate is used. The refractive index of these clad plates is a low thing, and is 1.29 to about 1.33. Therefore, in the material combination of the conventional core material and a clad plate, the light-receiving angle of an optical fiber is small, for example, it sets to a glass optical fiber. When F2 glass (refractive index 1.62) of the Flint system is used as core material and soda lime system glass (refractive index 1.52) is used as a clad plate 0.56 and the light-receiving angle theta will be 34 degrees, and numerical aperture also sets to a plastic optical fiber. When methacrylic resin (refractive index 1.49) is used as core material and a fluororesin (refractive index 1.39) is used as a clad plate, 0.54 and the light-receiving angle theta become [ numerical aperture ] 32.5 degrees. Thus, in the combination of the conventional core material and a clad plate, the light-receiving angle of an optical fiber is about 30-50 degrees, and since an optical fiber can convey only the light which carried out ON light at an angle of below a light-receiving angle, it needs to condense below on the above narrow light-receiving squares of an optical fiber.

[0004] Since the light-receiving angle of the light which can be transmitted is narrow, in order to complete sunlight below as the light-receiving angle of an optical fiber in the conventional sunlight beam condensing unit, it is necessary to always make the medial axis of a lens abbreviation parallel with sunlight, and to maintain the light-receiving side of the medial axis of a lens, and an optical fiber to an abbreviation perpendicular by the conventional optical fiber, as mentioned above. In order to lose gap of the focus by the solar diurnal motion and annual movement in the conventional sunlight beam condensing unit from this, solar tailing equipment was required. For this reason, the equipment in connection with solar tailing became complicated, and it had become the factor in which this raises cost.

**[0005]**